above this level the walls are 9.58 feet thick, whence they gradually decrease throughout the whole height of the shaft, until at the belt they are reduced to 2 feet in thickness. Above the shaft rests a cylindric belt 18 inches deep; and this is surmounted by a cavetto 6 feet high, and having 3 feet of projection. The contour of this cavetto is that resulting from a quadrant of an ellipse revolving about the centre of the tower, with a radius of 8 feet on the level of its transverse axis; and the moulds for this curve were drawn at full size from co-ordinates calculated for the purpose. The cavetto supports an abacus 3 feet deep, the upper surface of which forms the balcony of the tower, and above it rest the parapet-wall and lantern."

In the Eddystone and Bell Rock lighthouses the stones were dovetailed throughout the building. In the upper part of the Bell Rock a kind of band joggle was introduced, which consisted of a flat riband of stone raised upon the upper bed of one course, and fitting in to a corresponding groove cut into the under bed of the course above. Mr. Stevenson says—

"In the lower parts of the Skerryvore Tower, I entirely dispensed with dovetailing and joggles between the courses, and thus avoided much expensive dressing of materials. The stones were retained in their places during the early progress of the work, chiefly by common diamond joggles, and the courses were temporarily united to each other by wooden treenails, like those used in the Eddystone and Bell Rock. These treenails had split ends, with small wedges of hardwood loosely inserted, which, being forced against the bottom of the holes in the course below, into which the treenails were driven, expanded their lower ends until they pressed against the sides of the holes; while their tops were made tight by similar wedges driven into them with a mallet. I have, however, adopted the ribband-joggle in the higher part of the tower, where the walls begin to get thin in the very same manner as at the Bell Rock, where it was used, partly that it might counteract any tendency to a spreading outwards of the stones, and partly that it might operate as a kind of false joint to exclude the water which, when pressed with great violence against the Tower, is apt to be forced through a straight or plain joint. The stones in the higher courses throughout each ring are also connected at the ends by double dovetailed joggles, which unite the two adjoining stones; and the walls are, besides, tied together at various points by means of the floor stones, which are all connected by dovetails let into large circular stones which form the centres of the floors."

The operations of each year are given in detail, a chapter being appropriated to each. The granite was from the quarry of the Ross of Mull. The freight usually paid was 5s. a ton, and yet the whole of the blocks for the lighthouse tower were laid down at the rate of 2s. 1½d. per cubic foot, including all the expense of building barracks, opening quarries, freight of stones, and the expense of building and maintaining a vessel. Some particulars are given of quarrying granite.

All the materials required for the tower were dressed in such a manner as to avoid any fitting on the rock, and the greatest accuracy was therefore required in the formation of the mould from which the stones were shaped. A *trainer*, or radius, was made with a moveable vernier, capable of sliding along it, so as to give the differences between the readings of the feet as far as to the thirtieth part of an inch, and the architect was thus enabled to lay off the batter or slope on each course, according to a table of co-ordinates, with great nicety, and so as to trace very distinctly the contour of the intended column. Such nicety, as the author observes, "was by no means superfluous, because the arrangements of the tower precluded the possibility of using a trainer in building; and as the whole was done by means of *plumb-templets*, the greatest accuracy in tracing the curve of the tower became necessary, as the only true basis of good workmanship on the rock." The masonry of the tower contains 58,580 cubic feet, or about 4,308 tons.* The mortar used was composed of equal parts of Aberdda lime and Pozzolano earth.

We congratulate Mr. Alan Stevenson and the country on the successful completion of an arduous and important undertaking, and thank him much for his clear and interesting account of it.

REMARKS ON "ARCHITECTURAL MAXIMS AND THEOREMS."†

CONSTRUCTION.

"It will be perceived," says Mr. Donaldson in his preface, "that the subject has been divided into two parts—the art and the science; or, if it may be said with the schoolmen, into the metaphysics and physics of architecture: the one comprehending the abstract principles of taste in the combination of masses or substances, and the reason and understanding of the causes of certain emotions produced by them in the mind; the other treating on the qualities inherent in matter, and the proper application and combination of such materials in reference to construction."—(p. viii.) The discussion of that part of the work treating of architecture the fine-art I completed in my former paper; and I promised in the present continuation to take up the part treating of architecture the science—or what I would rather call constructive housebuilding, and the lecture on the practice, the "walk and conversation" (as the old writers would have said) of the architect.

Of course we were not to look for, in the sixty "maxims" under the head *construction*, anything approximating or pretending to a system of constructive science; all that appears to have been aimed at is simply the jotting down of a few valuable hints, axioms, facts,—a few pages contributed to the architect's stock of scientific knowledge.

These maxims, however, are systematically arranged according to the several departments into which the subject is divisible; and, so far as they go, there is a completeness about them, constituted by your having laid before you, with respect to every branch, some few notable points. But I rise from the perusal of them with disappointment: not that I can blame them for a deficiency which arises only from their fewness,—sure enough they pretend to be no more than "in elucidation of *some* of the principles" of the subject; but the disappointment is none the less keen which springs from their suggestion of the fact of how lamentably deficient our system of constructive science is altogether and at its best. Constructive science is a subject so complex, copious, diffusive,—a subject so very inadequately represented in the library,—withal a subject so very little really rationally, practically, known as it ought to be, that the great magnitude of the theme and the great need for the treatise together make these sixty maxims of Mr. Donaldson's only a sort of sixty crumbs to a hungry man. Very good crumbs they may be, and frequently of substance salutary and satisfying; but they are insufficient, and do little more than remind us of our wants.

I doubt not that such a thing as a thorough and perfect system of constructive building would be, at the present day, one of the most eagerly-purchased works that could be written in connection with our profession; and one would think that there are few subjects which offer to a scientific man of leisure so many promises of satisfaction. All we want is a diligent and clear-headed compiler of evidence and collector of facts; the materials are to be found anywhere, all ready to his hand,—stones upon the highway,—his work merely to collect, arrange, describe. It would not be amiss if certain energetic minds amongst us, instead of labouring to reduce to rule and order that which has no rule and order but in far deeper and more subtle elements than they seem capable of attaining to, would rather devote themselves to the investigation of useful truth in this less ambitious but more profitable path: verily, it is a pity that some of the spare enthusiasm, which has been of late years expending itself so earnestly and withal so noisily in measurements of crumbled walls, and rubbings of brasses, and torturings of the plans of old churches to reduce them to what is considered "geometrical proportion" (regarding which I would only suggest that it is quite possible, and there is no harm in admitting, that the old monks schemed their plans by all those ingenious fancies, provided you do not lose sight of the circumstance that in so doing they schemed their plans very foolishly, and wasted their ingenuity upon a very wild chimera)*—verily it is a pity, I say, that some of this spare enthusiasm should not now, by way of change and relaxation, if nothing else, attach itself to measuring principles of science, and rubbing down facts into system, and reducing plain, honest, useful knowledge to its plain, honest philosophy.

But I must pause to say that, perhaps, I am wrong in thus attributing to the construction of an encyclopædia of building so small an amount of difficulty. The task, if not one of deep thinking, as thinking goes now-a-days, would still be found in amount of research sufficiently laborious, and in variety and extent of comprehensiveness sufficiently perplexing, and demandant of scientific discernment and care, to entitle a properly complete and minute fulfilment of it to all the fame and merit of a great work: for, to be useful, it must be complete and minute, elementary and of thorough explication; not such a treatise as those of Gwilt and Bartholomew, although these are very praiseworthy in their way—so far as they go; but investigation of a more precise and painstaking manner, in a more formal and logical way, as if Professor Willis taught, or Dr. Arnott, or John Stuart Mill, or Linnæus, or Bacon, or Euclid of old. And in passing I would say that I have often regretted that the explications of Professors Donaldson and Hosking in the routine of their professorships should not be in some measure published, although it were merely in abstracts of what may happen to be novelties; without any chance of evil that I can think of, the suggestions and acquisitions of our two professed systematizers of the science, might, in such a way, most honourably to themselves, be made of important use, in reducing to a standard and authority what at present is too much left floating about in all the uncertainty of crude opinions, experiments, secrets, and tricks of trade.

The Encyclopædia of Building I would have to commence, of course, at the fundamental and primary. First, a somewhat voluminous subject, if rightly and fully discussed, is that of *plan*, an investigation of the arrangement of buildings in all departments of requirement and circumstance,—the explanation of *the system of buildings* fundamentally—the laying down and determining, as the commencement of the first proposition, what a building is. In the question of *site*, next, there is a good deal of philosophy to be opened up; climate, soil, level, access, approach, aspect, view, water, air, drainage, foundation, are subjects capable, every one, of considerable discussion. After which come the long array of *building operations and materials*—the digger, well-sinker, bricklayer, stone-builder, lime-maker, mason, pavier, slater, thatcher, carpenter, plasterer, joiner, plumber, smith, carver, glazier, painter, paperer; the brick and tile maker, quarrier, lime-burner, timber dealer, founder, ironmonger, glass-maker, and the rest in connection: all these in all the departments of their crafts,—not merely the tools they work with and the descriptions of work they do,—but the intricacies of what they themselves do not attain to—the science and *rationale* of their work and all their doings,—every process and every purpose and every preference and every piece traced logically to its principles and its science,—not a mere hasty statement of general axioms of practice, a mere dictionary of

* The cubic contents of the Eddystone are 13,343 feet.

† Read at a meeting of the Architectural Association, June 9th. For former portion see p. 263, *ante*.

* The harmonious result of this "foolish" scheming induces in us a very different opinion of it.—ED.

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